United States Military Academy
West Point, New York 10996

Analysis of the Research and Studies Program at the United States Military Academy

OPERATIONS RESEARCH CENTER OF EXCELLENCE
TECHNICAL REPORT No: DSE-TR-0426
DTIC #: ADA426262

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Abstract

The amount of time and effort devoted to research by the faculty at the United States Military Academy has been increasing over the past 20 years. Commensurately, the funding received by the departments and the research centers of excellence has grown dramatically. There are two significant complementary forces driving these increases:

1. More departments and faculty researchers are understanding the significantly positive value of conducting research on Army and DoD projects and its impact on their teaching cadets in the classroom, and

2. More organizations are aware of the impact US Military Academy researchers can have on their organization through the application of their analytical abilities combined with their military expertise.

The Dean of the Academic Board, BG Daniel Kaufman, wants to ensure that the outreach research program continues to grow by enabling researchers and facilitating their interaction with clients. Conversely, he also wants to ensure the research continues to improve the educational experience in the classroom and does not become its detriment. To accomplish this, BG Kaufman, requested the Department of Systems Engineering lead a team of analysts to determine the organization and approach required to meet the Academy's needs.

In this report we describe our application of the Systems Engineering and Management Process (SEMP) to the issue. This is the process we followed to develop our recommendation and explain our plan for implementation of that recommendation. The final recommended course of action which address the Dean's and other significant stakeholders needs, wants and desires is for the Academy to increase the size – and impact – of the Academic Research Division (ARD) and institute a Research Advisory Council to facilitate interdisciplinary interactions between departments and research centers.

About the Authors

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Major Andrew W. Koloski is an assistant professor and former department executive officer in the Department of History. He has a B.S. from USMA (1992) and M.A. from Stanford University (2002) in American History. His primary research interests are related to American foreign relations in the 20th century – particularly military interventions as tool of foreign policy at the turn of the century. Major Koloski can be contacted at Andrew.Koloski@usma.edu.

Second Lieutenant Ryan Kent is a Field Artillery officer and 2004 graduate from the United States Military Academy at West Point where he studied Systems Engineering. While at the Academy, Ryan was a stand-out student as well as a stand-out player on the Army Football team. He was the Team Captain his junior and senior seasons. His senior season he was selected to play in the Hula Bowl, a college football all-star game in Hawaii. He is currently a Graduate Assistant working with the 2004 Army Football team. His research interests include large scale systems analysis, especially those related to undergraduate education. He can be contacted at ryan.kent@us.army.mil.

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Chapter 1:   Introduction

To educate, train, and inspire the Corps of Cadets so that each graduate is a commissioned leader of character committed to the values of Duty, Honor, Country; professional growth throughout a career as an officer in the United States Army; and a lifetime of selfless service to the nation.

– Mission of the United States Military Academy (USMA Website, 2004)

As the above mission statement attests, the United States Military Academy exists for the sole purpose of producing Army officers – Second Lieutenants, to be more specific. All actions taken by the staff and faculty support the achievement of this mission. Though each organization at the Academy symbiotically contributes to achieving each aspect of the mission, it is clear that the primary burden of providing the cadets with a strong undergraduate education falls within the purview of the Dean of the Academic Board and the staff and faculty serving under him.

Conspicuously missing from this mission statement is the conduct of research for external organizations. In spite of this, research is taking an ever increasing percentage of the time of the faculty within the Dean's academic departments. There are some who point to the mission statement and claim that this research, since we are an undergraduate institution, does not support the mission and should not be valued or otherwise rewarded. These individuals undoubtedly would call themselves purists while others might call them myopic.

An increasing number of faculty members and leaders come to understand and support the role research plays in the accomplishment of the mission. They contend that research helps keep the instruction relevant and current. It also provides the cadets with "real" problems on which they can flex their intellectual skills. They also point to other benefits research provides to indirect, but desired outputs of the Academy system.

One of these outputs is the development of the faculty, especially the often, more-junior faculty who will rotate back to other Army units after three-year Academy tours. For senior military, more permanent, faculty members, and for their civilian counterparts research provides the means to develop in their chosen field in academia. For the Academy as a whole, the capability to provide valuable contributions to the Army through solving Army problems through intellectual application is a significant motivating factor for conducting research.

Of course, there is another significant motivating factor for conducting research – money. In times of reduced budgets, there is an ever increasing desire for Army and other government organizations to leverage the intellectual capability of the Academy faculty and its cadets. They are willing to share their budgets and invest in the departments' programs, which makes a compelling argument some use to push for a greater research role. Others use the same argument to push for the contraction of the time and effort devoted to research as it has, they claim, already taken from the teaching mission, an undesired and indirect output from the research.

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This study was not undertaken to decide the merits either for or against research. The simple fact exists that research at the Academy is growing and has reached a crossroads. The question at this crossroad is how we grow our research programs to attain the desired outputs of increased faculty and cadet development and displayed value while providing the proper oversight to ensure we minimize the undesired output of reducing the effectiveness of our teaching and education of our cadets.

In this report, we explain how our process and our recommendations for accomplishing this balance. Specifically, in Chapter 2, we provide a background for the research program at the Academy from its genesis to its current state to explain the motivation for this research. In the Chapter 3, we apply the Systems Engineering Management Process (SEMP) to the issue. This is a deliberate problem solving methodology especially effective when applied to large-scale, undefined systems. Finally, we summarize our report and make recommendations for the future.

Chapter 2:   Background on Research at USMA

2.1 The First Center

In the early 1980s, the military retirement system was being questioned by many in the government. It had become too expensive and was viewed as lucrative, especially in a time when there was an abundance of individuals wishing to remain the military. The Department of the Army however, viewed this as an attack on a significant benefit. Therefore, the then-Assistant Chief of Staff, Personnel (now known as the Army G1) LTG Stroop, wanted to develop a significant analytical based defense of the current system. He called in two individuals from the Department of Social Sciences at the United States Military Academy at West Point, LTC Tom Fagen and CPT Tom Daula.

This project led to the establishment of the Office of Economic and Manpower Analysis, or OEMA. This became the first formal organization at the United States Military Academy dedicated to research. This was a significant departure from the norm at the Academy at that time. Instructors were only required to teach, though some conducted research on their own. The research that OEMA conducted, they brought back into the classroom and found benefit in that it provided new, current material for the class work. Additionally, the cadets enjoyed working on significant, relevant problems instead of the tired problem sets previously used in the instruction.

In spite of these benefits to cadet education, the amount of research conducted at the Academy did not significant increase immediately. Slowly the number of centers grew and the number of individuals working in those centers increased. As can be seen in figure 1 and 2 below, there was modest growth in the number of centers and individuals working the centers in the 10+ years from the establishment of OEMA. The 10 years hence, leading to the present, however shows a significant increase in the number of centers and personnel.
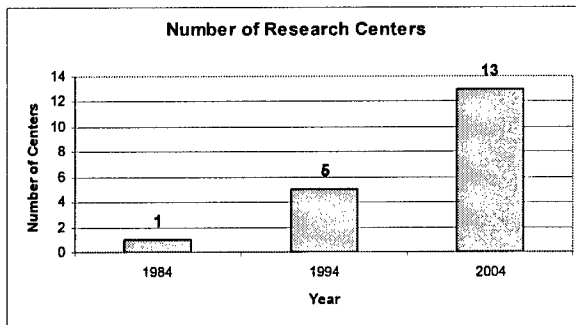
Figure 1: Number of Research
Centers at USMA
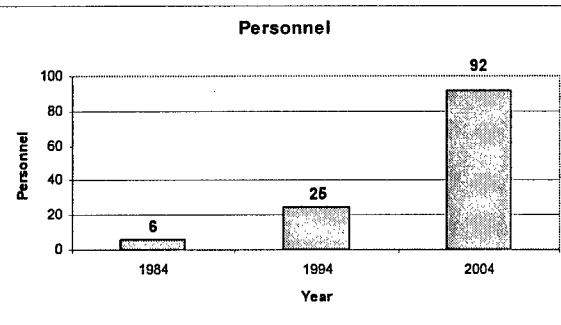
Figure 2: Personnel Working in
Research Centers at USMA

There are a number of explanations for this significant growth in the past 10 years. First and foremost, the increase can be attributed to the acknowledgement by nearly every department of obvious benefits to cadet education by bringing in current topics. The second reason for the increase is the recognized benefit to the faculty in their development as analysts by exercising their academic muscles. Thirdly, in the past few years, more agencies in the military are realizing the incredible opportunity provided by the faculty at USMA through their combination of academic excellence and military expertise. Finally, and arguably the most compelling rationale is the market force of increased funding. Figure 3 below shows the increase in funding received by the academic departments at USMA and the increases over the 10 year periods. Note the tremendous trend line up. This is a significant motivator for even more increases to the research program.
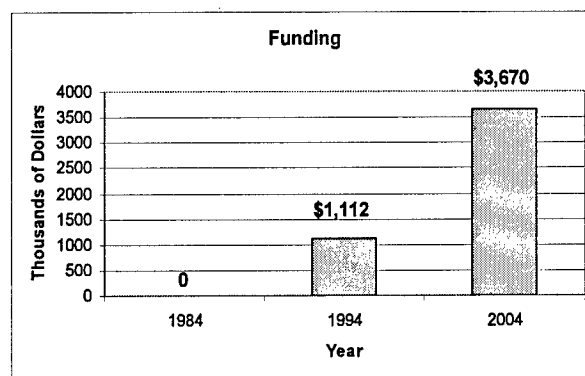
Figure 3: Outside Funding Obtained
by Research Centers at USMA

2.2 . The Potential and the Future

2.2.1. The Potential

Table 1, below, lists the there are 13 academic departments under the Dean of the Academic Board at the United States Military Academy, the two departments under the control of the

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Commandant of Cadets and the 13 Centers of Excellence. One can clearly see the vast reach of these programs across all disciplines and encompassing most research topics required by the military, the government and most civilian agencies.

| Academic Departments	Centers of Excellence
Behavioral Sciences and Leadership	Civil Engineering Research
Chemistry	Economic & Manpower Analysis
Civil and Mechanical Engineering	Enhanced Performance
Electrical Engineering and Computer Sciences	Environmental & Geographical Sciences
English	Information Technology Operations
Foreign Languages	Leadership & Organizations Research
Geography & Environmental Engineering	Mathematical Sciences
History	Mechanical Engineering Research
Law	Molecular Sciences
Mathematical Sciences	Operations Research
Physics	Photonics Research
Social Sciences	Teaching Excellence
Systems Engineering	Technology-Enhanced Language Learning
Commandant's Departments	
Physical Education	
Military Instruction	

Table 1: Academic Departments, Commandant's Departments and Centers of Excellence

The United States Military Academy is the highest concentration of advanced degrees in the Army. In all, there are over 579 faculty members at the United States Military Academy, not including the administrative staffs of the departments, the Office of the Superintendent, the Dean and the Commandant. This includes 270 military officers who hold a Masters degree, 168 military officers who hold a PhD, and 141 civilian faculty members (most of which hold a PhD). This is an incredibly potent research force for the Army and the Nation (Scully, 2004).

Some may claim that USMA does not have a research capability of a civilian university since it does not offer a graduate program (so cannot leverage graduate students). This is more than offset by a unique characteristic offered by the USMA faculty. Unlike civilian universities, the mostly military faculty at USMA comes with the spirit of cooperation grown through military service – this interdisciplinary spirit is ingrained in the military culture. By enabling and cultivating this interdisciplinary capability, there is an unbelievable potential remaining at the Academy for even greater levels of research and studies.

2.2.2. The Future
It would be quite simple to predict the future of research at the academy though simple projection of the trends from the past 10 year periods. Given this trend line and the

interdisciplinary capability detailed in the above paragraph, the future seems filled with research. Therein lays the problem.

From the Academy mission above, research is only part of the Academy in so much as it pertains to educating the Corps of Cadets. As research becomes a larger part of the faculty focus, there risks a danger of reducing the focus on teaching. Though some are concerned, it is important to note that it is widely accepted that it is still not a zero sum game between research and teaching – yet.

2.3 The Study

The Dean of the Academic Board, BG Daniel Kaufman asked the Department of Systems Engineering to conduct a study to analyze how the Academy should face the challenges and reap the potentials of research in the next ten years. Appendix B is the initial memorandum sent by the Dean to the Head of the Department of Systems Engineering.

In the memo, the Dean restricts the study only to determine the best approach for the Academy to implement to achieve its potentials. The study team looked at this problem both structurally and procedurally. We did not focus solely on the present issues; rather we looked at the next ten years and beyond.

Chapter 3:   Conduct of Study

Though the Dean of the Academic Board asked the Department of Systems Engineering to undertake this study, there were three main reasons to integrate in a team of analysts from other departments to assist in the effort. First, bringing in analysts from other departments gave those departments a means to influence the process. Second, the study did not become a "Systems" project but rather an "Academy" project. Third, there was a great deal of work to be accomplished in a short time and additional manpower was required.

Participation on the study team was voluntary and each Department Head was asked to provide an analyst to the team. The study lead was from the Department of Systems Engineering; five other departments provided representatives. The study team included:

LTC Michael J. Kwinn, Jr., PhD, Department of Systems Engineering (Study Lead)
COL Barry Shoop, PhD, Department of Electrical Engineering and Computer Science
COL Darryl Henderson, PhD, Department of Mathematics
LTC Robert Hansen, PhD, Department of Civil and Mechanical Engineering
LTC Kenneth McDonald, PhD, Department of Geography and Environmental Engineering
MAJ Andrew Koloski, MS, Department of History
2LT (then Cadet) Ryan Kent, Department of Systems Engineering Field of Study

This team met initially in January 2004 to discuss the direction of the study. They would apply the deliberate problem solving methodology taught in the Department of Systems Engineering known as the Systems Engineering Management Process (SEMP). This process, initially

developed by MAJ Daniel McCarthy while an instructor in the department, provides a framework to conduct detailed analyses on large scale, undefined (or ill-defined) projects. The process is shown in Figure 4, below.
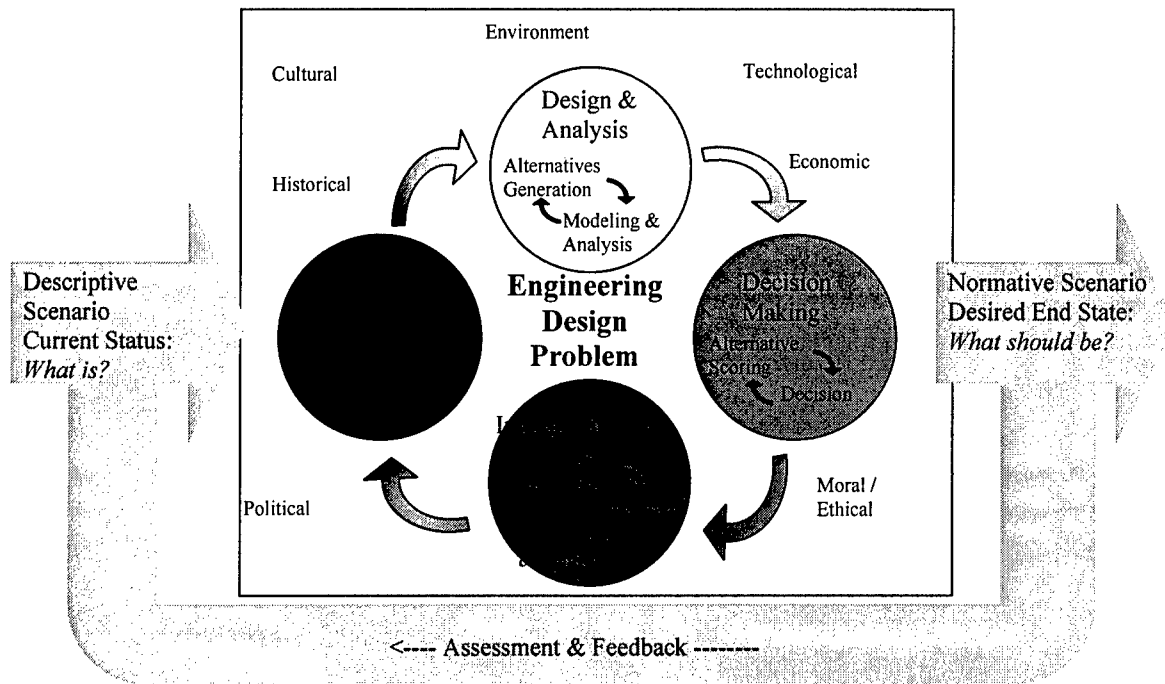
Figure 4: The Systems Engineering and Management Process (SEMP) (McCarthy, 2002)

The process consists of four iterative phases: the Problem Definition phase, the Design and Analysis phase, the Decision Making phase and the Implementation phase. Within these phases there are 11 steps. Each of these phases and the steps will be explained in greater detail in the following sections. Within this context, we will also explain the results of this study.

3.1 Problem Definition

The first, and most important, phase of the SEMP is Problem Definition. There are two primary desired outcomes of the Problem Definition phase: the Restated Problem and the Value Hierarchy. The first is the analysts' summary of the true problem, scoped and bounded, and defined in terms for further analysis. This is significant for the remainder of the analysis in that it is the problem on which we will work the remainder of the study. The second outcome is the Value Hierarchy. This is significant for the remainder of the analysis in that it will be used for comparing the alternatives generated in the follow-on phase.

To analyze the problem more in-depth, which will lead to the restated problem and the Value System Design, we interview all the individuals who have a stake in the problem or the outcome of the study. These individuals are termed Stakeholders. Therefore, we begin the study with Stakeholder Analysis.

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3.1.1. Needs and Stakeholder Analysis

Here, the analysts seek to better define the parameters of the study. In essence, they try to get to the real root of the problem. This search begins with the initial problem statement from the client. It is important to begin at this point as this is the point at which the client has begun the study – it is the initial common ground. For our study, this was the initial memorandum signed by the Dean for the Systems Engineering Acting Department Head (Appendix B).

The obvious stakeholders for this study are the Dean and his staff. Additionally, we identified the Department Heads and the Directors of the Centers of Excellence as significant stakeholders. Finally, we spoke with some clients and the current coordinator for research between the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASA(ALT)), Mr. Patrick Toffler, (Colonel, US Army retired). A complete list of stakeholders is at Appendix C.

Our first interview was with Dr. Kenneth Grice (Colonel, US Army retired). Dr. Grice provides us with significant insights into the initial motivation for the study and the bounds of the study. Based on our analysis of the initial problem memorandum and this interview with Dr. Grice, on 18 December 2003, we presented the Dean with our initial problem definition, our suggested directions for the study and our proposed timeline for completion of the study. The presentation is at Appendix D.

We include here for discussion only the initial statements in the presentation with which the Dean concurred at the presentation. It is important to note that from this initial briefing the Dean emphasized that he did not want the system to overly burden the Department's nor the researchers. It should not be an "approval process" but it should allow him to influence the research direction and keep him informed of on-going research at the Academy. Specifically, the system should:

> Provide a means to ensure oversight
> Provide info to Dean to make decisions on impact of mission
> Provide point of entry for research opportunities
> Develop research opportunities
> Communicate research capabilities to outside organizations
> Provide means for Dean to express to Departments long and short term research visions
> Keep Dean abreast of research at Academy
> Coordinate research between Departments (share research)
> Continue to provide review board for allocation of funds for research
> Not restrict Department research directions
> Not restrict researcher's initiative to develop opportunities
> Not be a research approval process

We continued with our interviews and consolidated the stakeholder comments. We told the interviewees that their interviews were non-retributional in that we would not associate their names with specific comments. We summarized their comments for the initial In-Progress Review given to the Dean on 9 February 2004. This presentation is at Appendix E.

Not all Department Heads and Center Directors were in agreement with how a system should be implemented at USMA for research. A minority of interviewees felt that the Dean should control all research and identify research for each department. This was not the most widely held opinion, however. Most significantly, this opinion was normally expressed by individuals in departments which did not conduct a significant level of outside research. Individuals from departments which conduct a significant amount of outside research (measured by number of studies as well as dollars) felt strongly that the Dean should not interfere with the department research programs. Though this contrast is not a surprising finding, it does highlight the difficulty of establishing a system across the Academy with departments that are so diverse in their approach to research.

From the stakeholders' needs, wants and desires, the team was able to elicit the functions required of any system and the values held by the significant stakeholders. It also provided some clarity into the "real" problem with research management at the Academy. Armed with this information, the team continued to develop the two significant take-aways from the Problem Definition phase of the SEMP – the Value System Design and the Restated Problem.

3.1.2. Restated Problem

Often when an analyst is initially approached by a client with a problem, the client does not fully articulate the complete scope of the problem or may state a perceived problem but not the real root cause. This is not due to a lack of understanding. It may be that the client has presupposed a solution in mind which focuses his or her statement of the problem. Another reason could be that the client has not surveyed the entire problem and does not acknowledge the extent of the problem. The insight into the root cause of the problem and the entire scope of the problem are for the analyst to discover and is the basis for the exhaustive approach to the Problem Definition phase of the SEMP.

In our analysis for this problem, the initial problem (or Primitive Need) which we were given from the Dean was to develop a system to

"...[ensure] interdisciplinary research & study activities are well-coordinated within the Academy, and that they effectively address the priority needs of all departmental programs as well as the needs of the Army and other sponsors and beneficiaries." (Memo from Dean, dtd 8 December 2003, appendix B)

Based on the needs, wants and desires of our stakeholders and the scoping of the problem based on guidance from the Dean and others, we developed a modified version of this problem definition:

Develop a system at the US Military Academy to coordinate the research and studies program so it provides academic freedom and research opportunity for faculty, provides support to research sponsors and researchers and provides the Dean of the Academic Board the visibility and oversight of research efforts across the Academy.

We feel that this restated problem addresses all the needs of the client and those of the prime stakeholders. This restated problem was approved by the Dean. This completes the Problem Definition Phase of the study. We have developed the restated problem which will become the focus of the remainder of the study. We now turn to the development of the VSD which will be used later to analyze the alternatives.

3.1.3. Value System Design

The Value System Design (VSD) is essentially a hierarchy of functions of the system and values of the stakeholders. It is a significant portion of the overall study in that it will be the baseline of the analysis of the alternatives. As this is a hierarchy, it is important that each 'branch" be independent of the others. This ensures that the measures at the bottom of each branch can "sum" to the top. It is difficult to achieve this as it requires the interactions of complex functions and values be artfully distinguished and accounted for in the design.

It also is important for the hierarchy to be complete. This means that they hierarchy must address all significant functions of the system and the values of the stakeholders. It must do this while being concise enough to allow further analysis of the problem. If the hierarchy becomes to large (in an effort to be comprehensive) it will not provide meaningful measures as the weights for each measure would be to small to impact the analysis.

The development of the VSD starts with the functional decomposition of the system under study. In developing this functional decomposition, the team used a technique known as Affinity Diagramming (HQ, US Navy, 2004). In this, the team identifies each of the significant functions of the system. This can be likened to brainstorming where each participant lists the functions associated with the study based on their inputs from the stakeholders.

This brainstorming can be accomplished electronically, using a software system such as GroupSystems©. It can also be done manually using PostIt© notes. In this manual method, the participant writes one function on a piece of paper and puts it on the board at the front of the room. When all participants are finished, the team collectively "groups" the functions. The groupings become the hierarchy. The functional decomposition we developed was presented to, and approved by, the Dean on 9 February during the first study In-Progress Review (IPR). This presentation is at Appendix E.

The Functional Decomposition was subsequently used to start the final development of the VSD. The VSD is similar to the functional decomposition in that it includes the functions but it also incorporates the values of the stakeholders. These are accounted for in two significant ways. First, the values can be added to the hierarchy itself by creating another branch or adding to existing branches. They are also included in the development of the weights for each of the measures. These weights are primarily a reflection of the client's values, but begin with a recommendation from the team based on the elicitations from the stakeholders.

Usually, the VSD is developed using another round of Affinity Diagramming. This helps ensure the team "gets it right". It is not unusual for there to be significant changes in the VSD from the initial functional decomposition as the SEMP is an iterative process and as more knowledge is gained the process improves. The final VSD is shown below in Figure 5.
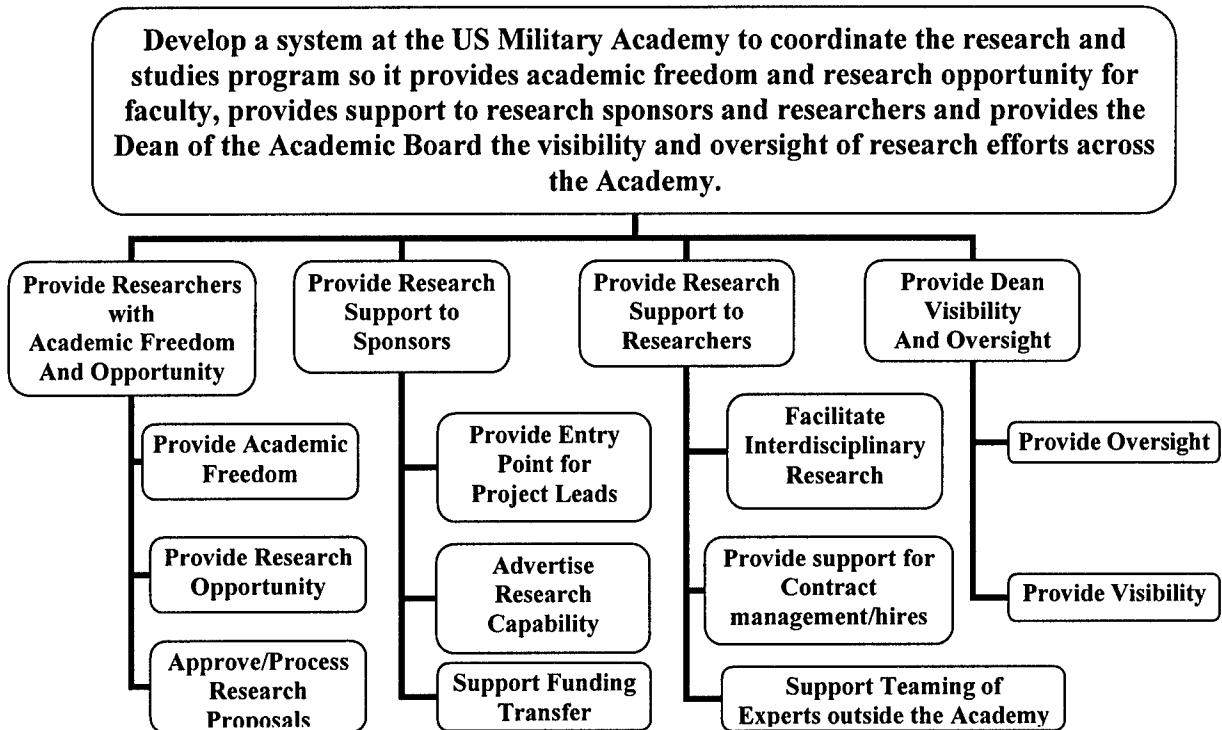
Figure 5: Value System Design

The final VSD includes the development of the measures and the weights for each measure used for further evaluation of the alternatives generated in the next step. For each value/function, the analyst identifies an objective. This clearly identifies what is best for the restated problem. Finally, the analyst determines how best to measure this value and objective. Measures are categorized according to their properties as shown in Table 2, below. The categories of measures are along the top and sides. In the middle of the box are examples. The priority order which the analyst would prefer the measures in the hierarchy are in parentheses.

	Natural	Constructed
Direct	Miles per Gallon (Fuel Efficiency) (1)	Olympic diving scores (2)
Proxy	GNP (Economic Growth) (3)	Grades (measuring Student Learning) (4)

Table 2: Types of Measures

Unfortunately, most of our measures were proxy measures and constructed scales. This will only affect our analysis based on our development of the scales. For each value we developed one objective and one measure. There can be more than one measure for an objective if required to fully analyze the scope of the issue. In this study, this was not required as we were able to measure each objective with one measure. Our list of values, objectives and measures are at Table 3, below.

Value	Objective	Measure
Provide Academic Freedom	Min number of directed projects	Number of directed projects
Provide Research Opportunities	Max Research Projects	Number of potential projects
Approve/Process Research Proposals	Min Number of levels above researcher for approval of research	Number of levels above researcher for approval
Provide entry point for project lead	Min number of entry points for Academy	Number of entry points
Advertise Research Capability	Max research advertising	Number of agencies seeing total capability
Support Funding Transfer	Min handling of funding transfer	Number of steps in funding transfer
Facilitate Interdisciplinary Research	Max effectiveness of interdepartmental communications	Number of interactions between Department research coordinators
Provide Support for Contract management and hires	Min department workload in contract management and hires	Number of Department hours required for contract management and hires
Support teaming of experts outside Academy	Min department workload in administration of work with other agencies	Number of Department hours required for administration of teaming agreements
Provide Dean Oversight	Max Resources controlled by the Dean	Number of resources controlled by the Dean
Provide Dean Visibility	Min time required to obtain research summary	Number of hours required to obtain research summary

Table 3: Values, Objectives and Measures

The final step in the development of the VSD is the establishment of the scoring functions. These are the mapping of the measures to value score between 0 and 100. This is required to use measures of different units for the same analysis. For example, we could not simply sum the miles per gallon and the color of the car when determining the type of car to purchase. We can identify how much "value" the client obtains from a level of miles per gallon and likewise with the color of the car and add the individual values (after adjusting for the client's weights on each measure).

This is a very significant step in the process and is usually done with the client directly. It can be a tedious process and therefore is often accomplished with the staff or, as in our case, the analyst making recommendations that are then approved for the final analysis. The scoring functions for each measure in our study are located in Appendix F. We now turn to generating the next phase of the SEMP, Design and Analysis.

3.2 Design and Analysis

Each subsequent phase of the SEMP relies on the take-aways from the previous. The take-aways from the previous Problem Definition phase were the Restated Problem and the Value System Design.

The Restated Problem will be used in the first step of this phase, Alternative Generation. The purpose of this step is quite obvious – to generate alternatives. We must be mindful that each alternative we generate addresses and solves the Restated Problem.

The Value System Design is then used as the basis of our analysis of these alternatives in the next step: Modeling and Analysis. Here we take the measures developed within the VSD and measure each alternative against these measures using models or other tools.

3.2.1. Alternative Generation

The important thing about alternative generation is that the analyst allows for all possible (and even impossible) potential solutions to the restated problem. Infeasible alternatives, if any, will be screened out later in the process. For the generation however, the more alternatives developed the better. This allows the analyst to explore "out of the box" thinking and possibly generate that alternative which is a truly unique, simple and bold solution to the problem.

Each alternative developed must not only solve the problem, but must be unique to the other solutions. It only clouds the analysis if two alternatives are so similar that they score the same in the following steps and phases. There are four main types of alternatives the analyst can generate:

Off-the-shelf – these alternatives are based on similar systems implemented elsewhere. In our case, similar systems are the research programs at the US Naval Academy, the US Air Force Academy, and Rose-Hulman University among others.

Current System – this is obvious. It is simply the "Do nothing" option but must be considered as we certainly do not want to develop a worse system than we already have employed.

Modified Current – these alternatives are developed based on modifying aspects of the current system. Modifications must be significant as we must have unique solutions. Small changes to the existing solution (or others) can be made at the end to solutions chosen so it is not necessary to include them in this category.

New Developments – these are completely new systems. One means of developing systems in this category is to employ Zwicki's Morphological Box. In this approach, the analyst lists each aspect of the system which can be modified and each of the states each modification can take. For example, in our study we can have proposals come into the Dean's office only, the Department's only, the Dean's office and the Department's or directly into the analysts. By taking one state from each potential modification, we can "build" an alternative. This is a quick and simple approach, but can lead to an extraordinary number of alternatives – some of which could be nonsensical.

After all the alternatives are generated, the analyst compares these to screening criteria, if any. These are criteria which come from hard constraints. An example for a possible bedroom set would be that the set fits in the bedroom. For our study, there were not significant screening criteria. We developed the following alternatives for further analysis:

No change (small ARD who collects research proposals with Military Interdepartmental Purchase Requests (MIPR), consolidates annual reports and provides some proposal assistance, Research Management Center separate from Office of Dean who manages partnerships, Departments control research directions and efforts).

Total Control at Office of the Dean level (Expanded ARD possibly to a Vice Dean level, all research requests go to Office of the Dean level for approval and coordination outside of USMA, research partnerships managed in this office, central point of contact for all research at West Point including funding and coordination).

No control at Dean level (Departments manage research within their purview and coordinate as the individual researcher or Department coordinators deem appropriate, partnership agreements at Academy level are eliminated as is the research coordination office, MIPRs are still coordinated through Dean's office for acceptance and annual reports are submitted by Department to the Dean annually or as required.)

Office at Dean level to manage research and existing partnerships (Essentially an ARD+ with Research Partnership Management Office, individuals/research centers can submit proposals to this office and this office can accept research opportunities from outside agencies for dissemination, research coordinated by Departments and research centers is submitted to this office for informational purposes, increased administrative support from current ARD levels with expanded staffing.)

Consolidate research centers (all Academy research will be managed through these centers, they will develop research opportunities for individuals and manage their completion, reports will be available on demand and annually.)

Establish a research advisory council (Representatives from all Departments and Centers of Excellence meet to coordinate research and approve topics, report is submitted to Dean, partnership manager is represented on the council.)

Establish Research Management Office at Academy/Supe level (Push Academy research to level of ODIA, teaching, etc level. Office would manage all aspects of research and provide an Academy front for coordinated research, would provide research support and oversight.)

3.2.2. Modeling and Analysis

Now that we have developed the alternatives for which address our restated problem, we turn back to the Value System Design for the analysis of the alternatives. At the bottom of each branch of the VSD, we identified one objective which we sought to attain for this value. We then developed measures for each. In this step, we score each alternative against each measure.

In many studies, this step is accomplished using models or simulations to derive the scores for each alternative and each measure. That was not appropriate for our analysis here. Modeling or simulating a potential means of securing research opportunities was not possible. When the alternative, or measure, cannot be modeled, analysts usually turn to expert opinions for their scoring. As most of the members on the study team were familiar with the research process, they provided the expert opinions for the scores for each alternative and measure. These scores are recorded in a table which we term the Raw Data Matrix: This matrix for our study is located at Appendix G.

We now are complete with the Design and Analysis phase of the SEMP. Our take-aways into the next phase are the alternatives and the raw data matrix. After generating and analyzing the alternatives, we move to the Decision Making phase of the SEMP.

3.3 Decision Making

It has been said that this is the phase that turns the water into wine. What is meant is that in this phase, the alternatives and the value system design come together and lead to a recommended solution to the problem. We accomplish this through Alternative Scoring and Decision Making steps.

3.3.1. Alternative Scoring

In this step, we convert the raw data matrix obtained in the previous phase into values using the value functions developed in the first phase of the SEMP. This provides us with the decision Matrix. This is how much value the individual alternative provides for each individual measure. The Decision Matrix is located at Appendix H. We are now ready to move to the next step, Decision Making.

3.3.2. Decision Making

This is the step where the recommended solution is finally discovered. The weights are applied to the Decision Matrix and the values for each alternative is summed revealing the final score, highest is best. For our analysis, the alternative scores, in rank order, are shown in Table 4, below.

Alternative	Score
Large ARD	64.49
Consolidated Research Centers	61.59
Total Dean Control	58.26
Supe Level	55.36
No Dean Control	49.27
No Change	47.39
Research Council	45.07

Table 4: Decision Matrix

Based on the scores above, the recommendation would be to implement a Large ARD. We now look to optimize the alternatives. This allows us to analyze the alternatives and try to improve on their weaknesses. One means to do this is to combine alternatives, which we see we can do since not all alternatives are mutually exclusive. Specifically, we see that we can combine the Large ARD alternative with the Research Council alternative.

After combining these alternatives and rescoring, we achieve a score of 79.13. This is significantly higher than all the other alternatives. Combining or further optimizing other alternatives either does not make sense or does not achieve a higher total score than 79.13. Prior to definitively making this our recommendation, we look at how changing the weights could affect the outcome, this is sensitivity analysis.

We consider changes of 10% in either direction for the individual weights. To conduct this analysis, we implemented the software package, Logical Decisions®. This package allowed us to vary the weights dynamically, that is, adjusting all the weights proportionally except the weight under examination.

The result of our analysis is that our combined alternative recommendation would not change with reasonable changes in the weights. The result will change if the metric to Maximize Dean's control of resources is given over 60% of the total weight. In this instance, the Total Dean Control alternative would score highest. Since this would equate to the Dean forcing the decision through his rank and position, we leave that his discretion and maintain our recommendation of the Large ARD and the Research Council.

We presented these findings to the Dean, COL Forsythe and Dr. Grice on 6 April 2004 (Appendix I). BG Kaufman accepted the presentation but did not direct continued study on the implementation of the alternatives at that time. The following day however, he sent the study lead, LTC Kwinn, his approval via email (Appendix J). He also directed that the team continue the analysis with the implementation phase of the SEMP.

3.4 Implementation

For the implementation phase, the research team broke into two groups to develop each part of the recommendation. The group which developed the structure and the responsibilities of the Large ARD was lead by COL Henderson. The group which developed the structure and responsibilities for the Research Advisory Council was LTC Robert Hansen. The teams presented their recommendations for implementation of the alternatives to the Dean, COL Forsythe and Dr. Grice on 27 May 2004. The presentation is at Appendix K.

The Implementation phase of the SEMP consists of three steps: Planning for Action, Execution and Assessment and Control. We will discuss in this section the three steps for each of the two parts of the recommendation starting with the Large ARD.

3.4.1. Large ARD

The current structure of the ARD consists of a director and two support staff. The recommended Large ARD consists of a staff of six, including the Director. It does not include the Facilitator for the Partnership between the Academy and the ASA(ALT). The team did not make a recommendation as to the continuation of the agreement and specifically the facilitator. The interactions of the facilitator was outside the scope of the analysis and the agreement was signed by the Dean of the Academic Board.

3.4.1.1 Planning for Action

The recommended structure of the Large ARD is seen in Figure 6, below. Our research team originally recommended an O6 be the Director. The rationale was that an Active Duty officer would be a good representative for the Academy in the Pentagon and other agencies throughout the Army. After discussing with the Dean and the Vice Deans, it was decided that the Director should Title X.

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                    ┌─────────────────────┐
                    │      Director/      │
                    │  Associate Dean for │
                    │  Academic Research  │
                    │      (Title X)      │
                    └─────────────────────┘
              ┌──────────────┴──────────────┐
    ┌───────────────────┐         ┌───────────────────┐
    │ Associate Director │         │  Admin Assistant  │
    │     (GS13/O5)      │         │       (GS7)       │
    └───────────────────┘         └───────────────────┘
       ┌─────────────────┬─────────────────┐
┌───────────────┐ ┌───────────────────┐ ┌───────────────────┐
│ Database Manager│ │Programs Coordinator│ │Research Assistant │
│     (GS5)      │ │       (GS6)        │ │      (GS9/11)     │
└───────────────┘ └───────────────────┘ └───────────────────┘
```
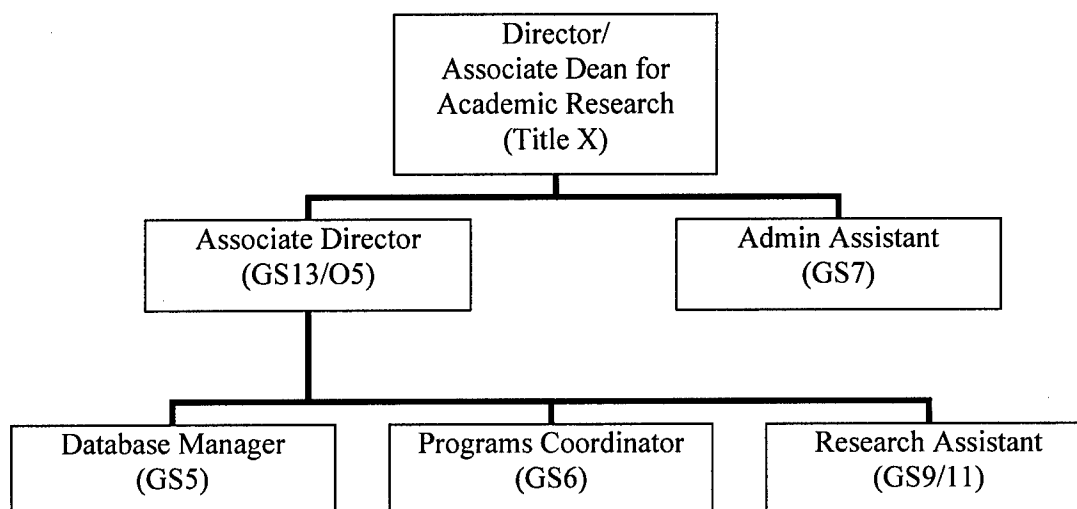
Figure 6: Recommended ARD Personnel Structure

The specific responsibilities for each position would be as follows:

Director (Associate Dean for Academic Research) – The Dean's source of research information, outreach and oversight. Responsible for providing a single source of information and communication with outside agencies who are querying USMA for research assistance (if not working directly with a department). Works with the Academy Research council to facilitate interdisciplinary research and information sharing. Qualifications include:

> Active research background with understanding of how the Army runs.
> Understand 6.1 research opportunities in the Army with ties to AMC and ARL.

Understand Joint processes
MEL 1 or equivalent civilian experience
Well connected in the Army and Civilian research community

<u>Associate Director</u> – The Director's expert in policies and procedures at the Academy and in preparing research proposals. Responsible for daily operation of the ARD. Central point of contact for all queries to the Academy and supports teaming outside the Academy (CRETA's, CTA's, MURI's, contracts and hires). Qualifications include:

Adeptness at interdisciplinary approach to research
In depth understanding of the Academy and research vision for each department

<u>Research Assistant</u> – Responsible for identifying and framing potential opportuninties for research. Responsible for researching proposal requirements and assisting departments in writing proposals.

<u>Programs Coordinator</u> – Responsible for accepting and tracking research funds. Manages shared funds and provides oversight on budgetary issues.

<u>Data Base Manager</u> – Maintains research data base and generates reports as required. Produces annual research summary and periodic newsletter. Maintains ARD Web presence.

<u>Administrative Assistant</u> – Provides administrative, travel and fiscal support as required.

3.4.1.2 Execution

The Academy conducts two general types of research: Department generated and ARD/partnership generated (see figure 7 and figure 8, below). Note that in Figure 8, ARD is the supporting agency in all aspects of the process. The only formal requirement is that ARD manages funds and funds transfers. This option maximizes departmental flexibility while keeping the Dean informed of on-going research.

Department   ARD or equivalent

Concept approved by Head prior
to committing resources   ARD assists as necessary

Department Head approves

            Info copy to ARD
              Reports to Dean

Department commits   ARD manages funds transfer
            Creates fund cite for Dept

Department tracks resources
   plan   Info to ARD - tied to customer cycle
   audit   Status of funds
   track and close out   Status of work
              Notified when closed out

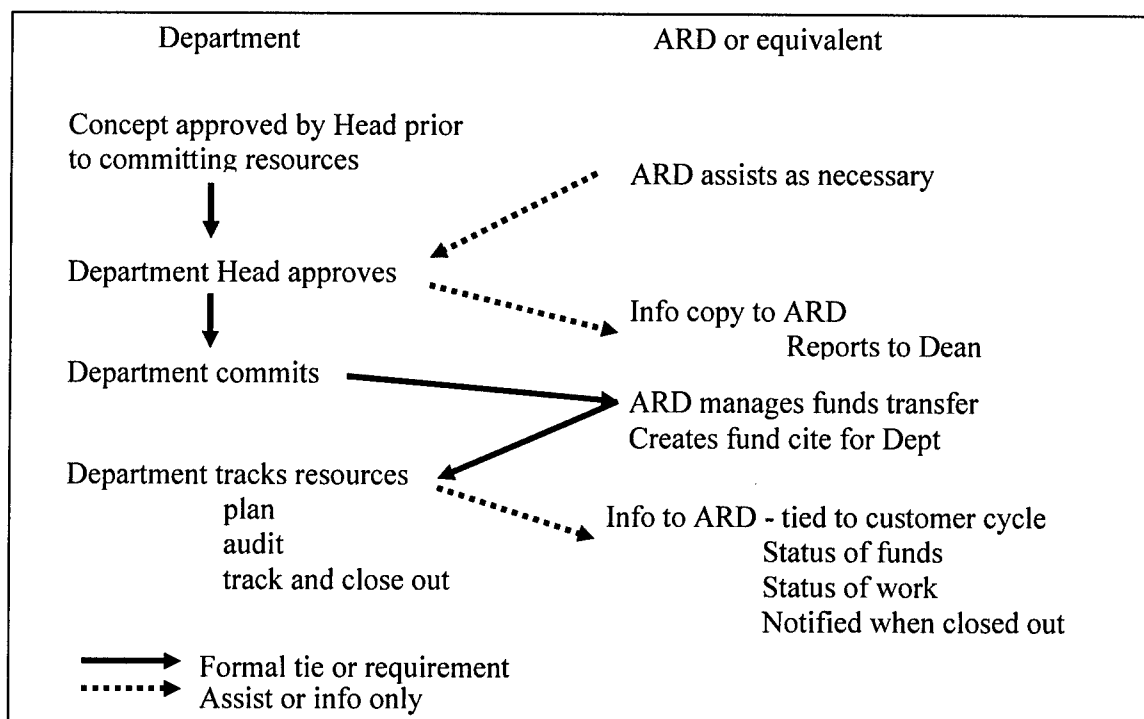→ Formal tie or requirement
⋯► Assist or info only

Figure 7: Work coordinated and generated by departments

As ARD develops contacts beyond the Academy, it will eventually generate potential research interests. In this case, ARD acts as the initial coordinator for the process until a department or departments are identified to accept the project (See Figure 8.). From that point on, the process is the same as that depicted in Figure 7.
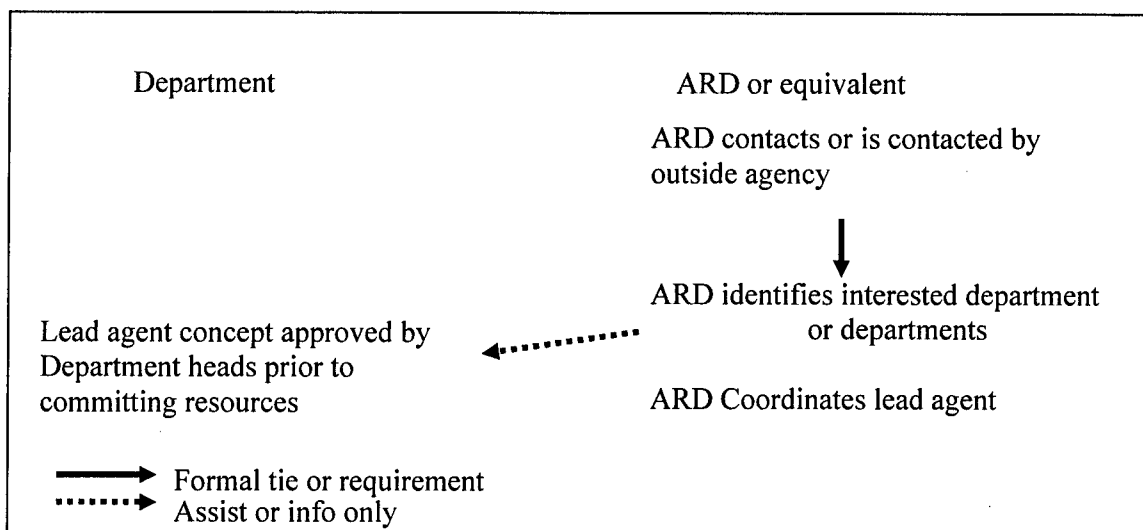
Department   ARD or equivalent

            ARD contacts or is contacted by
            outside agency

            ARD identifies interested department
Lead agent concept approved by   or departments
Department heads prior to
committing resources   ARD Coordinates lead agent

→ Formal tie or requirement
⋯► Assist or info only

Figure 8: ARD/Partnership Generated Research

3.4.1.3 Assessment and Control

At the end of each Academic year, the ARD will develop a research annual report. This report will be provided to each member of the Academic Board and to external agencies. This report will include a summary of the research undertaken by each department, to include a list of publications and presentations associated with the research. The purpose of this report will be to highlight activities and to advertise our capabilities.

Additionally, the ARD will submit a memorandum summary to the Dean of the Academic Board at the end of each Academic year. This memorandum will summarize the support provided by the ARD for the departments and researchers during the previous year. It will also highlight the ARD plan for developing research and support the departments and researchers in the coming year. The Dean will share this memorandum as deemed appropriate.

3.4.2. Research Advisory Council

3.4.2.1 Planning for Action

The Research Advisory Council will provide the various research elements at the United States Military Academy a formal venue to meet and discuss issues related to conducting research. It will function as a link between the faculty and the Dean for research concerns. The proposed mission statement of the United States Military Academy Research Advisory Council is:

> *To bring into cooperation the various USMA departments, centers, and agencies, DA and DoD research organizations, and other research communities with the objective of promoting the investigation and research of issues which are fundamental to the Army and the Nation.*

The research council will form for the following purposes:

To advise the Dean of the Academic Board on issues related to research at the Academy. The council provides the USMA faculty the opportunity to act in an advisory, consulting, and planning role. Such matters as the affect of research on teaching, availability of funding, logistical considerations, etc. may be documented by the council and serve as a means to inform the Dean of important developments that affect the academic program.

Promote the open exchange of ideas among USMA faculty and research centers. The council will strive to enhance the lateral flow of information by providing a forum for the consideration of matters of common interest to the USMA research community.

Enhance communications and information flow from the Dean to the USMA research elements. The council will provide a forum for the Dean to issue specific guidance on research directions or thrusts. Though this can information can be passed through the Department Heads, this council will allow the Dean to discuss his research guidance with the directors of the centers as well as the research coordinators for each department. He will also be able to obtain feedback

from the council members on research insights they are obtaining from clients and prospective clients on the needs of the Army. In this way, the Dean and the ARD Director will be more current in the research directions of the Army.

Responsibilities. The specific responsibilities of the council include:

- Approve the allocation of the Dean's research funds. These funds support relatively small projects based on proposals submitted by the USMA researchers to ARD.

- Review proposals for new USMA research centers and make recommendations to the Dean.

- Authority to call special meetings of the council (beyond regular quarterly meetings).

- Review Annual Research Report prior to distribution.

- Coordinate the exchange of research information and ideas.

- Coordinate the presentation by Partnership Facilitators and/or ARD representatives on research opportunities.

- Coordinate the presentation of outside agencies that potential research opportunities.

- Assist in formulating research policy (primarily an ARD staff function, but council provides initial department/center input)

3.4.2.2 Execution

Initially, the Research Advisory Council will establish specific roles and functions. The items identified above will serve as initial guides. The council will also establish meeting times and locations, normally instituted by the council chair.

Council Composition and Meeting Conduct. The voting membership of the Research Council will consist of representatives from:

Each academic department
Department of Military Instruction
Department of Physical Education
USMA research center directors

Non-voting members will include representatives from the Academic Research Division and the liaison representative from the ASA(ALT) research memorandum.

Membership by departments is on a voluntary basis. The council chair will be on an annual rotating basis, selected from among the department or center representatives by the membership.

Quarterly meetings will be scheduled by the council chair. The membership will submit agenda items.

Other entities are allowed to attend research council meetings and provide input at the discretion of the above membership. An example of non-members attending would include agencies internal or external to USMA that wish to explain research opportunities they offer.

3.4.2.3 Assessment and Control

Annually, the Research Advisory Council will prepare a short summery of their actions and recommendations for the following year. These recommendations can be research based (suggestions on research thrusts for the following year) or organizational (suggestions on the make-up or continuation of the council) or on responsibilities of the council. This report should be submitted from the council chair, through the ARD Director to the Dean of the Academic Board.

Chapter 4: Summary and Conclusions

Research conducted by the faculty of the United States Military Academy is valued in that it enhances cadet education and opportunities, it develops the junior and senior analysts, and it directly provides contributions of value to the Army and the Nation. The primary goal of any research program at the Academy must be to further enhance these research opportunities and in no way restrict their development or execution.

Meeting the above objective is difficult as the tendency is to implement either of the extreme approaches: *laissez-faire* approach with no oversight or completely direct and control all research. The former may lead to overcommitted resources or lack of focus on the teaching mission while the latter may lead to lack of interest on researchers to work on problems. Both are contrary to the mission of the Academy and the direction provided by the Dean to this study team.

That said, any process which exploits the interdisciplinary potential of the Academy's faculty is to be rewarded. This is a key advantage our faculty has over most other universities and research centers. Again, this potential must be tempered so as to not undervalue the individual researcher or individual discipline research. Both have their place in the academic setting and research arena.

To meet these competing and actually contradicting objectives, we have here applied a deliberate problem solving methodology, the Systems Engineering and Management Process (SEMP), to divine a solution. This process lead the team to recommend and develop an implementation plan on the combination of two alternatives developed within the process: A larger and more supportive ARD and a Research Advisory Council.

Individually, neither of these alternatives stood out or addressed all the issues raised by the stakeholders or the client. When combined however, they will serve to greatly enhance the

research opportunities we have as a faculty as well as provide the visibility required to make important resource decisions.

As the United States Military Academy moves through the 21st Century its impact in the research community within the Army and the Department of Defense will grow, as its history has shown. Research will provide greatly expanded opportunities for cadets to interact with important problems and divine their solutions. These opportunities will be directed by junior and senior faculty members conducting this research. The end result will be a more relevant education and therefore better leaders. Better leaders will result in a better Army and a better, more secure Nation and that is, after it is all said, precisely our mission.

Bibliography

United States Military Academy website, http://www.usma.edu, visited June 2004.

SE301 Course Notes, Major Daniel McCarthy, SE301 Course Director, Department of Systems Engineering, August 2002.

HQ US Navy, "Basic Tools for Process Implementation: Module 4 Affinity Diagramming", http://www.hq.navy.mil/RBA/affinity.pdf, visited June 2004.

Research and Sponsored Program Office Operations, Naval Postgraduate School, http://intranet.nps.navy.mil/resadmin/, visited March 2004.

United States Air Force Academy website, http://www/usafa.edu, visited March 2004.

Rose-Hulman University website, http://www.Rose-Hulman.edu, visited March 2004.

Deckro, Dr. Richard, Department of Operational Sciences, Air Force Institute of Technology, phoncon 24 March 2004.

Appendix A: List of Abbreviations

A	
AMC	Army Materiel Command
ARL	Army Research Lab
ASA(ALT)	Assistant Secretary of the Army for Acquisition, Logistics and Technology)
C	
CRETA	
CTA	
D	
DMath	Department of Mathematics
DoD	Department of Defense
DTIC	Defense Technical Information Center
EECS	Department of Electrical Engineering and Computer Science
GNP	Gross National Product
M	
MEL	Military Education Level
MIPR	Military Interdepartmental Purchase Requirement
MURI	Multi-University Research Initiative
O	
ORCEN	Operations Research Center
S	
SE	Systems Engineering
SEMP	Systems Engineering Management Process
U	
USMA	United States Military Academy
V	
VSD	Value Systems Design

Appendix B: Initial Need Memorandum

OFFICE OF THE DEAN
UNITED STATES MILITARY ACADEMY
WEST POINT, NEW YORK 10996-500

MADN   13 November 2003

Memorandum For COL William Klimack, Acting Head, Department of Systems
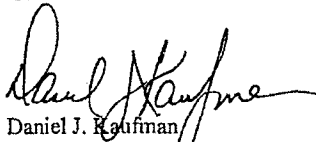Engineering

Subject: Architecture for Interdisciplinary Research & Studies (R&S) at the United
States Military Academy (USMA)

1. In support of the USMA mission, our faculty and cadets are engaged in research and
studies supporting their individual areas of interest and expertise. Presently, a major
proportion of our effort properly is focused on research & study projects on behalf of the
Army and the defense community. These projects support cadet and faculty development
across different departments while contributing to national defense; as such they are a
valuable and growing component of the four-year West Point Experience. Such
interdisciplinary activities are important force multipliers; however, they also require
coordination and team work to be both efficient and effective.

2. My desire is that our interdisciplinary research & study activities are well-coordinated
within the Academy, and that they effectively address the priority needs of our
departmental programs as well as the needs of the Army and other sponsors and
beneficiaries. Presently, we have no formal mechanism or process that generates a
coordinated Academy research and study plan. Such an Academy R&S plan would be
both beneficial for internal coordination and as well as in external discussions with Army
and other sponsors for adjudication, support and funding, if appropriate.

3. Accordingly, I am directing you to develop options that will address the policies,
organization, and processes whereby USMA can plan for the conduct of interdisciplinary
R&S. Your effort should be consistent with the present levels of research and studies
coordinated by my Academic Research Division, the MOAs existing between USMA and
the DoD/DA agencies, and a possible expanded R&S effort in the future. Your
recommendation should include an Academy-Army framework within which present and
future (proposed) USMA research and study projects can be developed and funded
cooperatively, in conjunction with USMA, Army and Defense priorities.

4. Any resources that you may require in support of this tasking will be provided. As a
minimum, you are authorized to request the support of my staff, all Departments, and
Centers of Excellence. While it is not required that a department or center participate in a
particular interdisciplinary R&S effort, I do expect that all will aid in the formulation of
an effective R&S program. I ask that you provide me with periodic IPR's and a
coordinated recommendation NLT 31 March 2004.

Cf: Daniel J. Kaufman
Each academic department head   Brigadier General, US Army
                                             Dean of the Academic Board

Appendix C: List of Stakeholders

The study team interviewed the following individuals in support of this study.

BG Daniel Kaufman, Dean of the Academic Board
COL David Albee, Head – Department of Chemistry & Life Sciences
COL Robert Doughty, Head – Department of History
COL Patrick Finnegan, Head – Department of Law
COL Anthony Hartle, Head – Department of English
COL William Held, Head – Department of Foreign Languages
COL Russ Howard, Head – Department of Social Sciences
COL Wendell King, Head – Department of Geography & Environmental Engineering
COL William Klimack, Acting Head – Department of Systems Engineering
COL Thomas Kolditz, Head – Department of Behavioral Sciences & Leadership
COL Gary Krahn, Head – Department of Mathematical Sciences
COL Stephen LaRocca, Director – Center for Technology Enhanced Language Learning
COL Maureen LeBeouf, Head – Department of Physical Education
COL Kim Nygren, Head – Department of Civil & Mechanical Engineering
COL Eugene Ressler, Head – Department of Electrical Engineering & Computer Sciences
COL Andrew Stanley, Head – Department of Military Instruction
COL Thomas Weafer, Director – Office of Professional Affairs
COL Ronald Welch, Head – Information & Educational Technology Division
COL Raymond Winkle, Jr., Head – Department of Physics
Dr. Kenneth Grice, Vice Dean of Resources
Dr. Stephen Landowne, Dean of Academic Research
Dr. Gary Washington, Director – Center for Molecular Science
LTC Vernon Davis, Director - Photonics Research Center
LTC Darrell Massie, Director – Mechanical Engineering Research Center
LTC Tyge Rugenstein, ARL Research
MAJ Ronald Dodge, Director – ITOC
MAJ James Ness, Director – Leader Development Research Center

Appendix D: Initial Briefing to the Dean

Architecture for Interdisciplinary Research and Studies at the United States Military Academy

LTC Michael J. Kwinn, Jr., Study Lead
Director, Operations Research Center of Excellence

Initial Briefing to Dean 18 December 2003

Operations Research Center of Excellence
Researching the Army's Future
Developing Tomorrow's Leaders

Purpose

- Conduct initial client interface
- Obtain concurrence on
  - Conduct of Study
  - Timeline of Study
  - Client needs, wants, desires from "proxy" client interview
- Show off cool new briefing template

Operations Research Center of Excellence
Researching the Army's Future
Developing Tomorrow's Leaders

Study Purpose and Motivation

▪ **Purpose**: "...[ensure] interdisciplinary research & study activities are well-coordinated within the Academy, and that they effectively address the priority needs of all departmental programs as well as the needs of the Army and other sponsors and beneficiaries."

▪ **Motivation**: Level, complexity and complexion of research at USMA has increased dramatically.

Process

▪ Follow the Systems Engineering Management Process (SEMP)

Study Plan

- Organize a team to conduct study
  - Solicited members from Departments
  - Will add credibility to results and allow more coverage
  - Will include at least one independent study cadet
- Conduct Stakeholder interviews with all principles
  - Dean and staff
  - Department Heads and reps (incl DMI and DPE)
  - Research Center Directors

Study Briefings and Timeline

- **IPR 1**: End of January – Stakeholder Analysis/Problem Definition
- **IPR 2**: End of February – Alternative Generation and Analysis
- **Final Briefing**: End of March – Decision Making and presentation of implementation plan

Proxy client interview summary – System Needs

- Means to ensure oversight
- Provide info to Dean to make decisions on impact of mission
- Should provide point of entry for research opportunities
- Should develop research opportunities
- Should communicate research capabilities to outside organizations
- Provide means for Dean to express to Departments priorities for research – long and short term visions

Proxy client interview summary – System Needs (continued)

- Keep Dean abreast of research at Academy
- Coordinate research between Departments (share research)
- Continue to provide review board for allocation of funds for research
- Should not restrict
  - Department research directions
  - Researchers initiative to develop opportunities
- Not a research approval process

Proxy client interview summary – System Boundaries

- System should be developed to account for expansion of research program
- No restrictions on adding or deleting manpower within Dean's purview
- No restrictions on space requirements

Note: Alternative analysis and final implementation plan will account for personnel and facility demands of system

Architecture for Interdisciplinary Research and Studies at the United States Military Academy

LTC Michael J. Kwinn, Jr., Study Lead
Director, Operations Research Center of Excellence

Initial Briefing to Dean 18 December 2003

Appendix E: First In-Progress Review to the Dean

Architecture for Interdisciplinary Research and Studies at the United States Military Academy

LTC Michael J. Kwinn, Jr., Study Lead
Director, Operations Research Center of Excellence

IPR 1 to Dean 9 February 2004

Operations Research Center of Excellence
Researching the Army's Future
Developing Tomorrow's Leaders

Purpose

- Present update on progress of study to date
  - Summary of stakeholder analysis
  - Initial value hierarchy
- Obtain concurrence on
  - Stakeholder feedback
  - Initial value hierarchy
  - Timeline of Study

Operations Research Center of Excellence
Researching the Army's Future
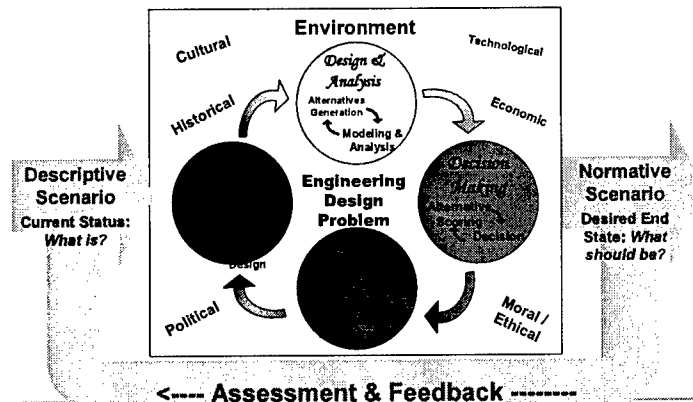Developing Tomorrow's Leaders

Study Purpose and Motivation

■ **Purpose**: "…[ensure] interdisciplinary research & study activities are well-coordinated within the Academy, and that they effectively address the priority needs of all departmental programs as well as the needs of the Army and other sponsors and beneficiaries."

■ **Motivation**: Level, complexity and complexion of research at USMA has increased dramatically.

Process

■ Follow the Systems Engineering Management Process (SEMP)

Study Plan

- Organized a team to conduct study
  - COL Shoop, EECS
  - COL Henderson, Math
  - LTC Hansen, CME
  - LTC McDonald, GEnE
  - MAJ Koloski, History
- Conducted Stakeholder interviews with all principles
  - Dean and staff
  - Department Heads and reps (incl DMI and DPE)
  - Research Center Directors

Stakeholder Analysis Summary

- System should:
  - Provide opportunities to conduct research
  - Provide "someone to talk to" at West Point about research
  - Advertise our capabilities to outside organizations
  - Facilitate exchange of research going on at West Point between USMA organizations
  - Provide support for proposal and grant preparation
  - Provide a means to "shop" proposals
  - Expand our research opportunities

Stakeholder Analysis Summary

■ **System should not:**
- Present barriers to research
- Interfere with existing research programs
- Be a requirements driven organization
- Direct research that "has" to be done
- Be an approval organization
- Coordinate over-arching agreements which are not merit-based as they make USMA look like a donor organization
- Expand our research opportunities too much

Stakeholder Analysis General Comments

■ Why do we do research – it is not in our mission statement?

■ Research focus and priorities from the Dean would be useful.

■ The Dean directing what we must work on or how much work we could do would not be helpful.

■ We need to be wary of how much research we take on – not a research institution.

■ Tracking money does not mean we are tracking research

■ All research does not have to be interdisciplinary, but some would be good, too.

Functional Decomposition

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                        ┌─────────────────┐
                        │    Academy      │
                        │ Research Program│
                        └────────┬────────┘
         ┌───────────────────────┼───────────────────────┐
   ┌──────────┐            ┌──────────────┐          ┌──────────────┐
   │ Provide  │            │  Coordinate  │          │  Coordinate  │
   │ Oversight│            │  Externally  │          │  Internally  │
   └────┬─────┘            └──────┬───────┘          └──────┬───────┘
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Provide Tracking Of Research	Manage Research Relationships	Provide Administrative Assistance
Provide Vision/ Guidance to Depts	Provide Central Research POC	Provide Research Opportunities
	Advertise Research Capability	Facilitate Interdisciplinary Sharing
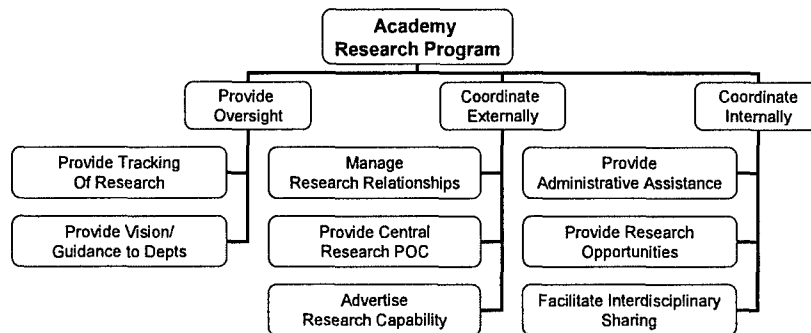
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Study Briefings and Timeline

- **IPR 1**: End of January – Stakeholder Analysis/Problem Definition
- **IPR 2**: End of February – Alternative Generation and Analysis
- **Final Briefing**: End of March – Decision Making and presentation of implementation plan

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Architecture for Interdisciplinary Research and Studies at the United States Military Academy

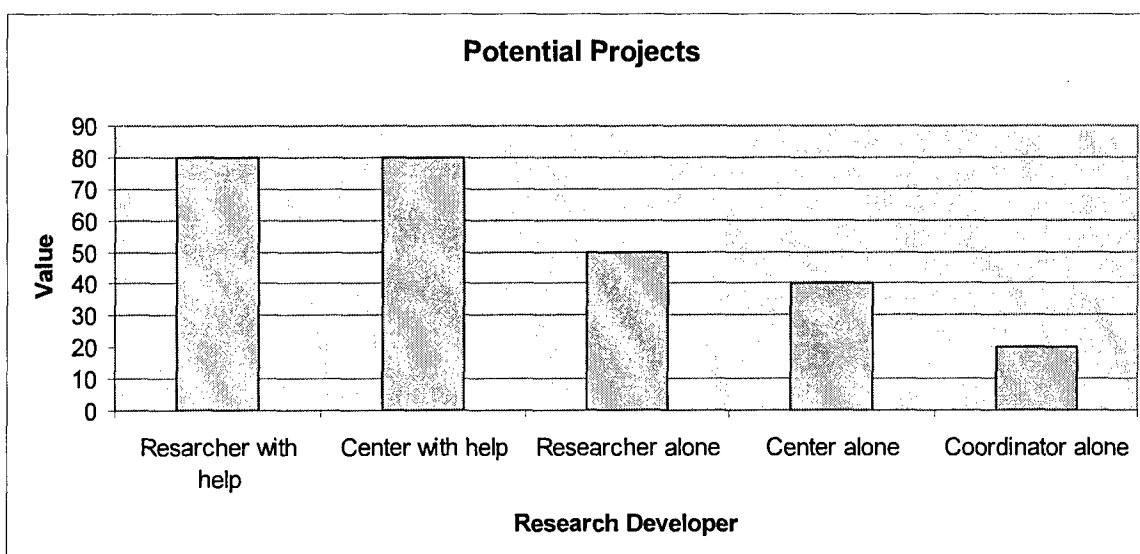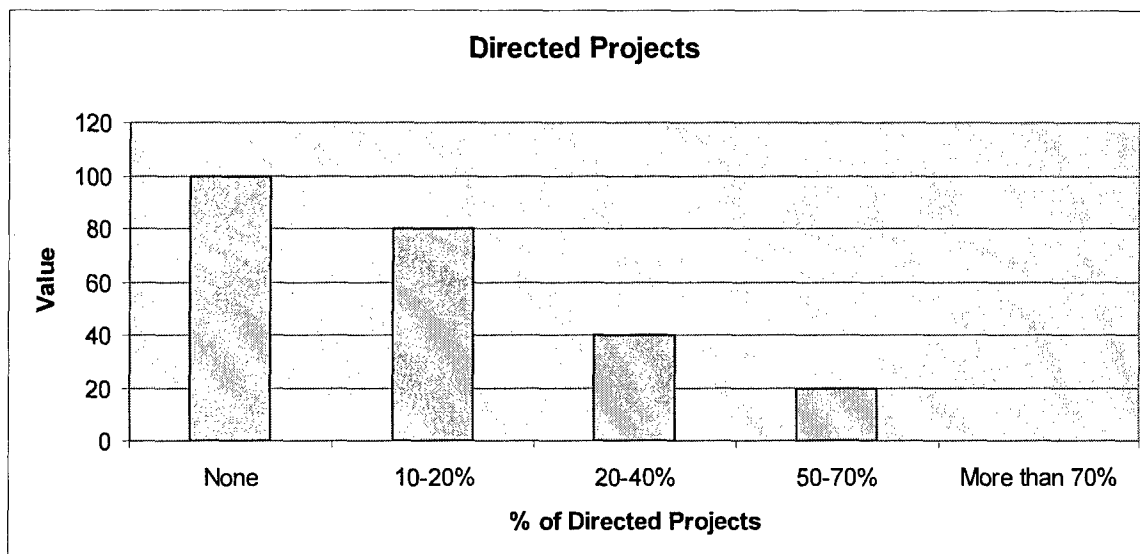**LTC Michael J. Kwinn, Jr., Study Lead**
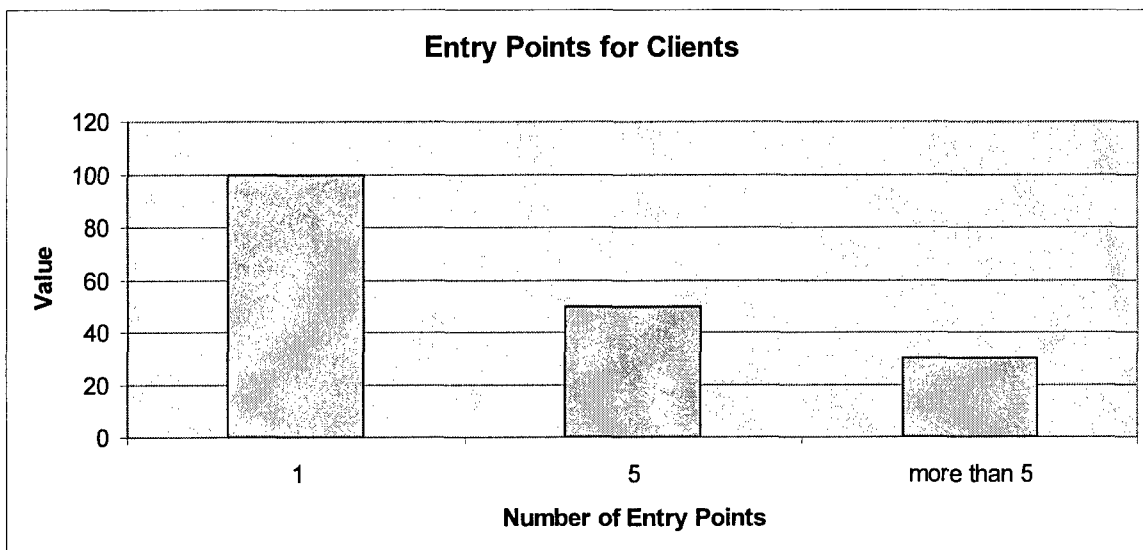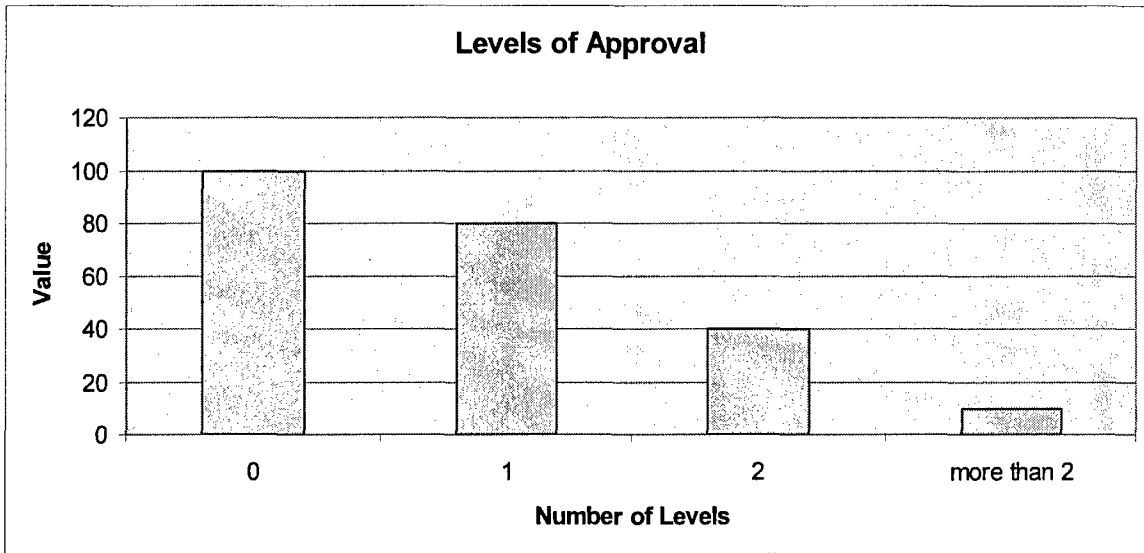**Director, Operations Research Center of Excellence**
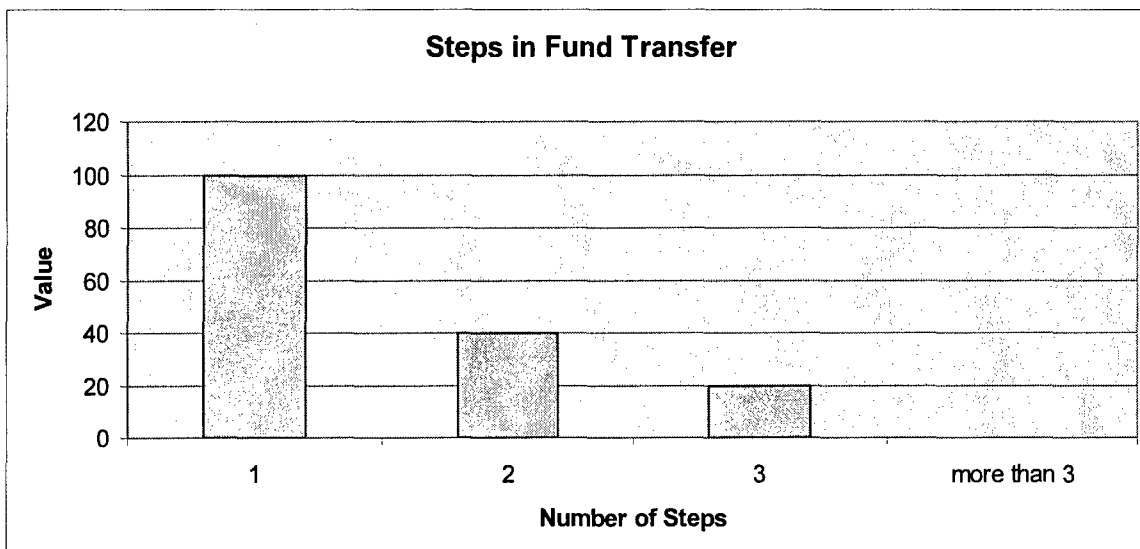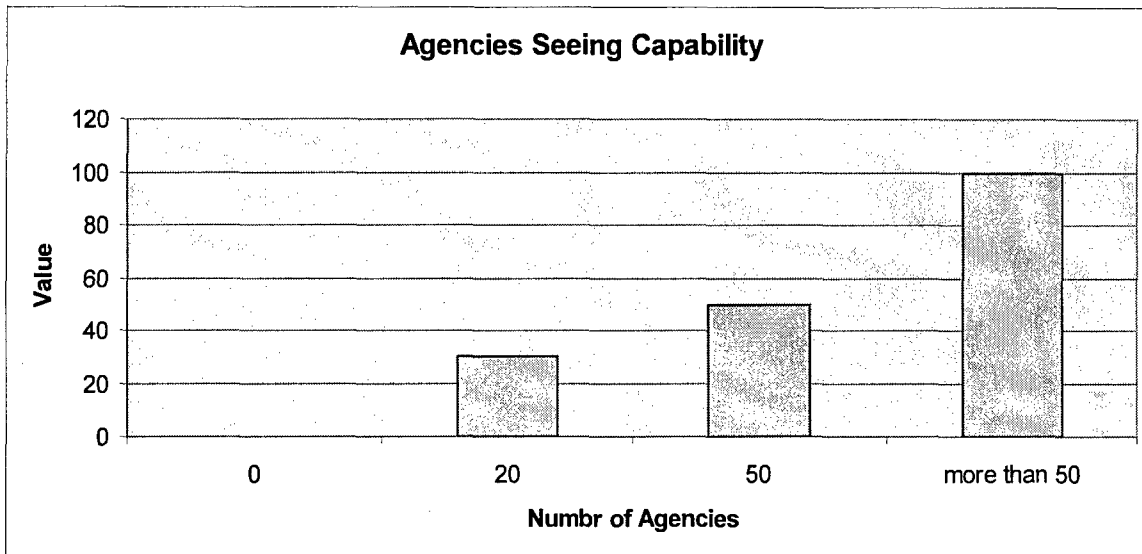
IPR 1 to Dean 9 February 2004

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Appendix F: Scoring Functions

The following charts are the scoring functions used in the analysis. We developed one scoring function for each metric. These are used to transform the metric to a dimensionless Value score. All of these functions are constructed scales. This means that they are discrete entries. Though this is not the "best" type of scoring function, it was necessary as the data for the alternatives could not be determined through surveys or modeling.

Directed Projects

Value (y-axis, 0 to 120)

Bars: None ≈ 100, 10-20% ≈ 80, 20-40% ≈ 40, 50-70% ≈ 20, More than 70% ≈ 0

% of Directed Projects (x-axis)

Potential Projects

Value (y-axis, 0 to 90)

Bars: Researcher with help ≈ 80, Center with help ≈ 80, Researcher alone ≈ 50, Center alone ≈ 40, Coordinator alone ≈ 20

Research Developer (x-axis)

Levels of Approval

A bar chart titled "Levels of Approval" with the y-axis labeled "Value" ranging from 0 to 120, and the x-axis labeled "Number of Levels". The bars show: 0 → 100, 1 → 80, 2 → 40, more than 2 → 10.

Entry Points for Clients

A bar chart titled "Entry Points for Clients" with the y-axis labeled "Value" ranging from 0 to 120, and the x-axis labeled "Number of Entry Points". The bars show: 1 → 100, 5 → 50, more than 5 → 30.

Agencies Seeing Capability

Steps in Fund Transfer

Research Interactions

Chart: Research Interactions

- X-axis: # of Research Interactions (categories: 0, 1, 3, always)
- Y-axis: Value (0 to 120)

Approximate values:
- 0: 20
- 1: 50
- 3: 70
- always: 100

Hours to Prepare Contracts

Chart: Hours to Prepare Contracts

- X-axis: # of Hours Required (categories: 1 or 2, 3 or 4, 5 or 6, more than 6)
- Y-axis: Value (0 to 120)

Approximate values:
- 1 or 2: 100
- 3 or 4: 80
- 5 or 6: 40
- more than 6: 20

Hours Required to Develop Teams

X-axis: # of Hours Required (1 or 2, 3 or 4, 5 or 6, more than 6)
Y-axis: Value (0 to 120)

Resources Controlled by the Dean

X-axis: Amount of Resources (all, most, some, few, none)
Y-axis: Value (0 to 120)

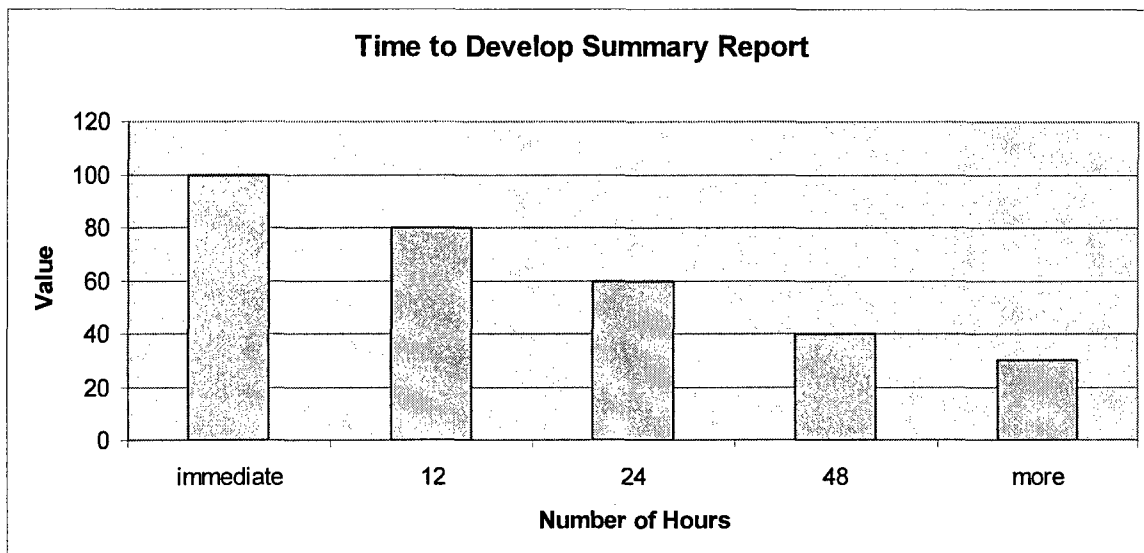**Time to Develop Summary Report**

Appendix G: Raw Data Matrix

This matrix displays how each alternative was scored for each metric. This information will then be transformed to a value through the application of the scoring functions. This information will be displayed in the decision matrix in the following appendix.

	No Change	Total Dean Control	No Dean Control	Large ARD	Consolidated Research Centers	Research Council	Supe Level Control	Combo
# Directed Projects	10-20%	> 70%	None	10-20%	50-70%	20-40%	>70%	10-20%
# Potential Projects	Researcher w/ help	Coordinator alone	Researcher alone	Researcher w/ help	Center Alone	Center w/ help	Coordinat or Alone	Researcher w/ help
# Levels for Approval	1	2	1	2	2	2	>2	1
# Entry Points	>5	1	>5	5	5	>5	1	1
# Agencies Seeing Capabilities	20	20	20	>50	>50	50	>50	>50
# Steps in Fund Transfer	2	1	1	2	2	2	1	2
# Research Interactions	0	3	0	0	always	3	1	3
# Hours for Contracts	>6	1 or 2	>6	3 or 4	3 or 4	>6	1 or 2	3 or 4
# Hours for Teaming	>6	1 or 2	>6	3 or 4	1 or 2	>6	1 or 2	3 or 4
# Resources Controlled	few	all	none	some	most	few	none	some
# Hours to Report to Dean	48	immediate	>48	12	12	48	12	immediate

Appendix H: Decision Matrix

This matrix shows the converted value of each alternative for each metric. Finally, this is summarized with the weights and shows the ultimate scores for each alternative.

	Weights	No Change	Total Dean Control	No Dean Control	Large ARD	Consolidated Research Centers	Research Council	Supe Level Control	Combo
# Directed Projects	0.130435	80	0	100	80	20	40	0	80
# Potential Projects	0.144928	80	20	50	80	40	80	20	80
# Levels for Approval	0.115942	80	40	80	40	40	40	10	80
# Entry Points	0.086957	30	100	30	50	50	30	100	100
# Agencies Seeing Capabilities	0.101449	30	30	100	30	100	50	100	100
# Steps in Fund Transfer	0.072464	40	100	100	40	40	40	100	40
# Research Interactions	0.101449	20	70	20	20	100	70	50	70
# Hours for Contracts	0.086957	20	100	20	80	80	20	100	80
# Hours for Teaming	0.086957	20	100	20	80	100	20	100	80
# Resources Controlled	0.043478	30	100	10	50	70	30	10	50
# Hours to Report to Dean	0.028986	40	100	30	80	80	40	80	100
Total	1	47.826	58.260	49.275	64.492	61.594	45.072	55.362	79.130

Appendix I: Decision Briefing to the Dean

Architecture for Interdisciplinary Research and Studies at the United States Military Academy

LTC Michael J. Kwinn, Jr., Study Lead
Director, Operations Research Center of Excellence

Project Presentation to the Dean of the Academic Board - 6 Apr 04

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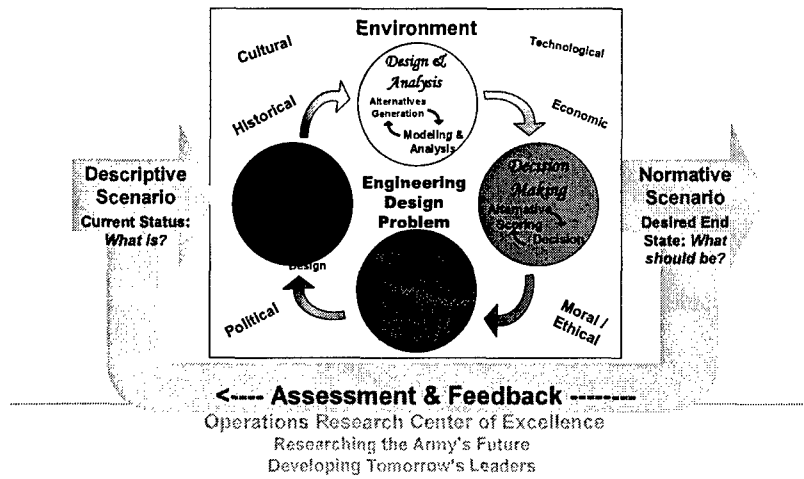Developing Tomorrow's Leaders

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Purpose

- Information Briefing on Study Summary

- Seek guidance on future work

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Process

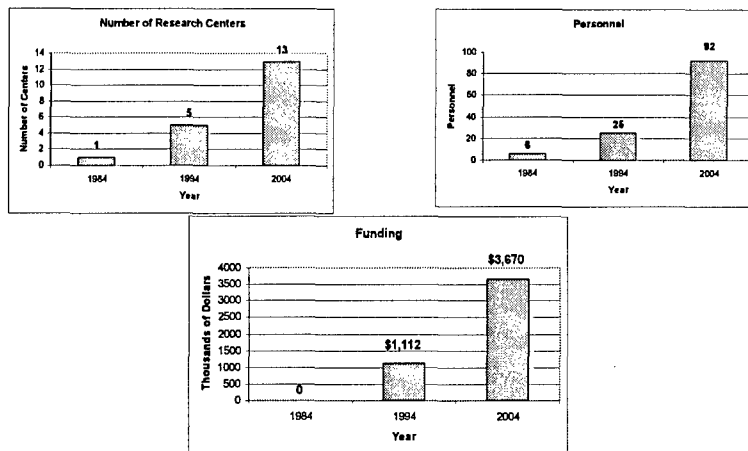■ Follow the Systems Engineering Management Process (SEMP)

Study Purpose and Motivation

■ **Purpose**: "…[ensure] interdisciplinary research & study activities are well-coordinated within the Academy, and that they effectively address the priority needs of all departmental programs as well as the needs of the Army and other sponsors and beneficiaries."

■ **Motivation**: Level, complexity and complexion of research at USMA has increased dramatically.

Research at the Academy

Number of Research Centers
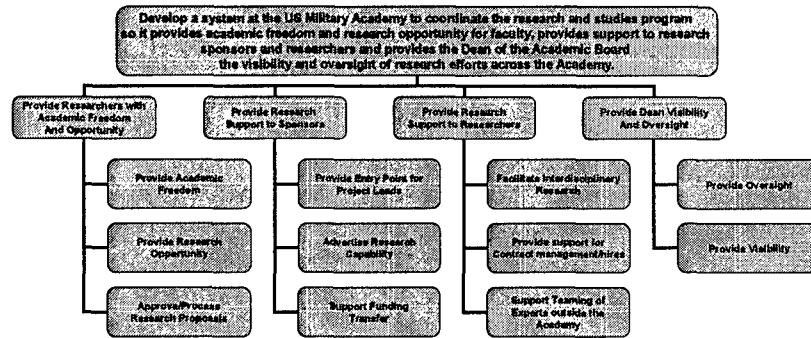

Personnel

Funding

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Study Plan

■ **Organized a team to conduct study**
- COL Shoop, EECS
- COL Henderson, Math
- LTC Hansen, CME
- LTC McDonald, GEnE
- MAJ Koloski, History
- Cadet Ryan Kent

■ **Conducted Stakeholder interviews with all principles**
- Dean and staff
- Department Heads and reps (incl DMI and DPE)
- Research Center Directors

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Value Hierarchy

Values and Measures

Value	Objective	Measure
Provide Academic Freedom	Min number of directed projects	Number of directed projects
Provide Research Opportunities	Max Research Projects	Number of potential projects
Approve/Process Research Proposals	Min Number of levels above researcher for approval of research	Number of levels above researcher for approval
Provide entry point for project lead	Min number of entry points for Academy	Number of entry points
Advertise Research Capability	Max research advertising	Number of agencies seeing total capability
Support Funding Transfer	Min handling of funding transfer	Number of steps in funding transfer
Facilitate Interdisciplinary Research	Max effectiveness of interdepartmental communications	Number of interactions between Department research coordinators
Provide Support for Contract management and hires	Min department workload in contract management and hires	Number of Department hours required for contract management and hires
Support teaming of experts outside Academy	Min department workload in administration of work with other agencies	Number of Department hours required for administration of teaming agreements
Provide Dean Oversight	Max Resources controlled by the Dean	Number of resources controlled by the Dean
Provide Dean Visibility	Min time required to obtain research summary	Number of hours required to obtain research summary

Process

- Follow the Systems Engineering Management Process (SEMP)

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Lateral Systems

- **US Naval Academy** – Centralized research review board for all research
- **US Air Force Academy** – One main research cell
- **Naval Postgraduate School** – Dean of Research, provides administrative support, has budget to support research
- **AFIT** – Similar to NPS
- **Rose-Hulman** – Researchers develop their own research, has interdisciplinary university level research "incubator" cell

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Alternatives

1. **No change** (small ARD who collects research proposals with MIPR requests, consolidates annual reports and provides some proposal assistance, Research Management Center separate from ODean who manages partnerships, Departments control research directions and efforts).

2. **Total Control at ODean level** (Expanded ARD possibly to a Vice Dean level, all research requests go to ODean level for approval and coordination outside of USMA, research partnerships managed in this office, central point of contact for all research at West Point including funding and coordination).

3. **No control at Dean level** (Departments manage research within their purview and coordinate as the individual researcher or Department coordinators deem appropriate, partnership agreements at Academy level are eliminated as is the research coordination office, MIPRs are still coordinated through Dean's office for acceptance and annual reports are submitted by Department to the Dean annually or as required.)

4. **Office at Dean level to mange research and existing partnerships** (Essentially an ARD+ with Research Partnership Management Office, individuals/research centers can submit proposals to this office and this office can accept research opportunities from outside agencies for dissemination, research coordinated by Departments and research centers is submitted to this office for informational purposes, increased administrative support from current ARD levels with expanded staffing.)

5. **Consolidate research centers** (all Academy research will be managed through these centers, they will develop research opportunities for individuals and manage their completion, reports will be available on demand and annually.)

6. **Establish a research council** (Representatives from all departments and Centers of Excellence meet to coordinate research and approve topics, report is submitted to Dean, partnership manager is represented on the council.)

7. **Establish Research Management Office at Academy/Supe level** (Push Academy research to level of ODIA, teaching, etc level. Office would manage all aspects of research and provide an Academy front for coordinated research, would provide research support and oversight.)

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Alternative Scoring and Decision Making

Alternative	Score
4. Large ARD	64.49
5. Consolidated Research Centers	61.59
2. Total Dean Control	58.26
7. Supe Level	55.36
3. No Dean Control	49.27
1. No Change	47.39
6. Research Council	45.07

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Optimization of Alternatives

▪ Not all alternatives are mutually exclusive
▪ Combining Research Council alternative with Large ARD and No Control at Dean level alternatives addresses weakness
▪ Still not enough to improve No Control alternative
▪ Large ARD and Research Council score becomes 79.13 – significantly higher than all other alternatives
▪ This result is not sensitive to changes in overall weighting of the value hierarchy

Recommendation

▪ ARD be expanded to include Research Management Office, provide increased support in terms of manning, contract management, teaming with outside agencies and improved tracking of research
▪ Institute a Research Council which includes all Department Research Coordinators to discuss research topics and directions

Additional Recommendations

- Enforce current research agreements so sponsors provide POC in their office to coordinate research
- Study Research Centers
  - Define what makes a center
  - Determine if we have the right ones
- The Associate Dean for Academic Research must have a strong research background, remain current in Academy research activities, and actively engage organizations outside of the Academy. The Associate Dean for Academic Research must be respected as a researcher and understand the research community and processes.
- Track research proposals through database
- Get annual reports out much more quickly to advertise capability and impact.

Architecture for Interdisciplinary Research and Studies at the United States Military Academy

LTC Michael J. Kwinn, Jr., Study Lead
Director, Operations Research Center of Excellence

Project Presentation to the Dean of the Academic Board - 6 Apr 04

Appendix J: Approval Email from the Dean

Kwinn, M. LTC SE

Mike:

I wanted to get back to you before you leave on your trip with some guidance on the way ahead for you and your committee on the management structure for research at USMA.

I approve the recommendations you presented yesterday. Specifically, I approve an approach that expands ARD and establishes a research council. Please proceed to the implementation phase of the SEMP. As you and your committee proceed, I would ask that you keep in mind two "first principles." First, research reinforces the teaching mission; it enhances cadet learning as well as contributes to faculty development. It is not my intent that we attempt to become a research institution; we are an undergraduate teaching college. Second, the purpose of the management structure is to provide visibility at the Dean's level of ongoing research efforts and activities. The Office of the Dean will facilitate the management and oversight of research activities, not control them.

Please pass along my congratulations to the other members of your committee for a job well done. Please let me know if there is any support that I or my office can provide as you move into the implementation phase of your study.

DK

Appendix K: Final Implementation Briefing to the Dean

Architecture for Interdisciplinary Research and Studies at the United States Military Academy

LTC Michael J. Kwinn, Jr., Study Lead
Director, Operations Research Center of Excellence

Implementation Briefing to the Dean of the Academic Board – 27 May 2004

Operations Research Center of Excellence
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Purpose

- Implementation recommendation for Research and Study plan for US Military Academy
  - Cover ARD make-up, responsibilities and roles
  - Cover Research Council make-up responsibilities and roles
- Seek guidance on future work

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Study Team

- LTC Mike Kwinn, DSE
- COL Shoop, EECS
- COL Henderson, Math
- LTC Hansen, CME
- LTC McDonald, GEnE
- MAJ Koloski, History
- Cadet Ryan Kent

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Recommendation (Approved for further analysis 6 April 2004)

- ARD be expanded to include Research Management Office, provide increased support in terms of manning, contract management, teaming with outside agencies and improved tracking of research
- Institute a Research Council which includes all Department Research Coordinators to discuss research topics and directions
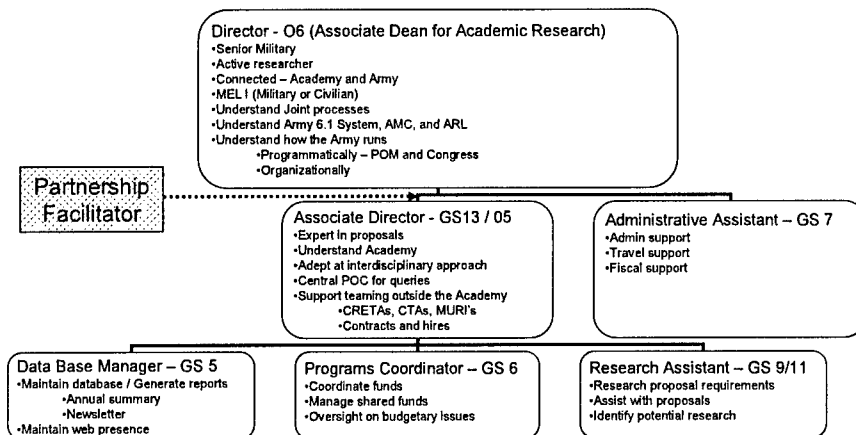
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Academic Research Division Proposal

USMA Research and Study Plan Team

Proposed Organization

Director - O6 (Associate Dean for Academic Research)
- Senior Military
- Active researcher
- Connected – Academy and Army
- MEL I (Military or Civilian)
- Understand Joint processes
- Understand Army 6.1 System, AMC, and ARL
- Understand how the Army runs
  - Programmatically – POM and Congress
  - Organizationally

Partnership Facilitator

Associate Director - GS13 / 05
- Expert in proposals
- Understand Academy
- Adept at interdisciplinary approach
- Central POC for queries
- Support teaming outside the Academy
  - CRETAs, CTAs, MURI's
  - Contracts and hires

Administrative Assistant – GS 7
- Admin support
- Travel support
- Fiscal support

Data Base Manager – GS 5
- Maintain database / Generate reports
  - Annual summary
  - Newsletter
- Maintain web presence

Programs Coordinator – GS 6
- Coordinate funds
- Manage shared funds
- Oversight on budgetary issues

Research Assistant – GS 9/11
- Research proposal requirements
- Assist with proposals
- Identify potential research

ARD Summary

- GS structure needs to be attractive enough to recruit and maintain quality personnel
- Director should be Academy Professor with research experience – stability is key to maintaining connections and credibility
- Director will be TDY a significant amount of time – attracting and coordinating research and outreach
- Associate director should compliment the director and be able to stand in when required with same presence
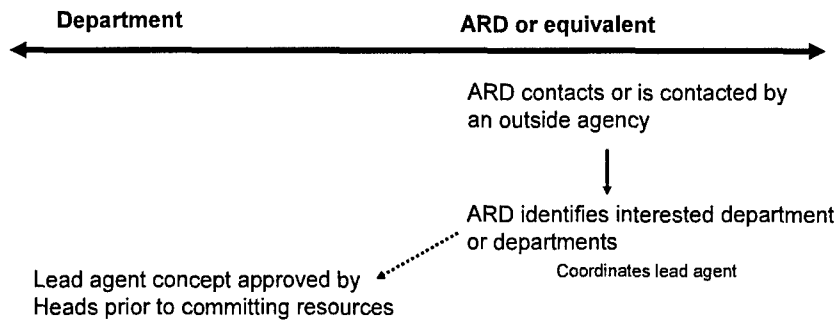- Member of the interdisciplinary research council

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Department Generated Research
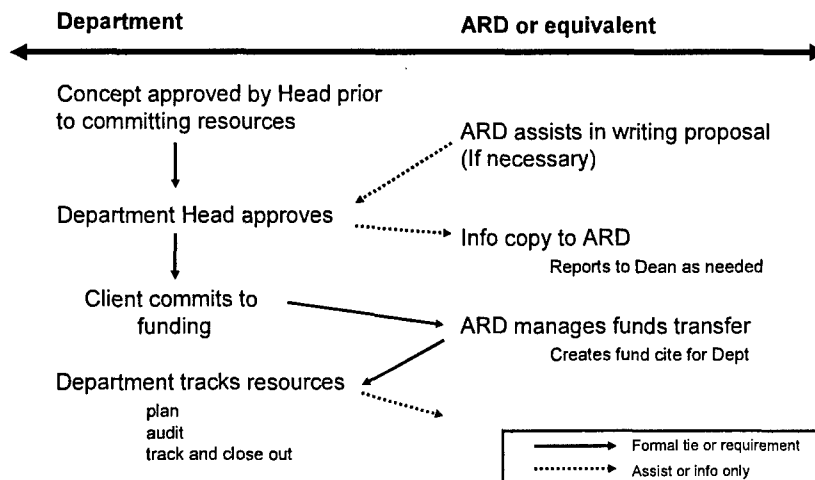
Department   **ARD or equivalent**

Concept approved by Head prior
to committing resources

ARD assists in writing proposal
(If necessary)

Department Head approves

Info copy to ARD
Reports to Dean as needed

Client commits to
funding

ARD manages funds transfer
Creates fund cite for Dept

Department tracks resources
plan
audit
track and close out

Formal tie or requirement
Assist or info only

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ARD/Partnership Generated Research

Department   **ARD or equivalent**

ARD contacts or is contacted by
an outside agency

ARD identifies interested department
or departments

Coordinates lead agent

Lead agent concept approved by
Heads prior to committing resources

The rest of the process is the same as the department generated process

---

Research Council Proposal

USMA Research and Study Plan Team

Mission Statement

To bring into cooperation the various USMA departments, centers, and agencies, DA and DoD research organizations, and other research communities with the objective of promoting the investigation and research of problems that are fundamental to the Army and the Nation.

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Research Council Goals

- Allow USMA faculty to act in an advisory, consulting and planning capacity to the Dean.
- Provide a forum for the consideration of matters of common interest to the USMA research community.
- Provide an open forum for interchange of ideas between the faculty researchers and centers.
- Provide a forum for the Dean to provide guidance on research directions or thrusts.
- Monitor the affect of research on teaching

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Structure

- Participants:
  - department reps
  - center directors
  - ARD
  - Partnership Facilitator
- Others may contribute through not directly assigned to council
- Council lead to be determined by council from Department or Center reps

Responsibilities

- Approving body for
  - allocation of Dean's research funds
  - new USMA research centers
- Authority to call special meetings of the council (beyond regular quarterly meetings)
- Reviews Annual Report prior to distribution
- Provide forum for exchange of research projects
- Provide forum for Partnership Facilitator and/or ARD rep to discuss research opportunities
- Provide forum for outside agencies to address research directors for potential research

Functionality

- Functions as a link between the faculty and the Dean for research concerns
- Voting members are each of the participants listed under structure
- Quarterly meeting agenda items submitted by participants
- Assist in formulating research policy (primarily an ARD staff function, but council provides department/center input)

Timeline for Implementation

- Should be functional NLT start of Academic year
- First meeting of research council should be late August or early September
- ARD hiring and restructuring should begin immediately to ensure it is ready
- Impact of waiting another year for implementation of plan is minimal

Architecture for Interdisciplinary Research and Studies at the United States Military Academy

LTC Michael J. Kwinn, Jr., Study Lead
Director, Operations Research Center of Excellence

Implementation Briefing to the Dean of the Academic Board – 27 May 2004

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13. SUPPLEMENTARY NOTES

14. ABSTRACT
The amount of time and effort devoted to research by the faculty at the United States Military Academy has been increasing over the past 20 years. Commensurately, the funding received by the departments and the research centers of excellence has grown dramatically. There are two significant complementary forces driving these increases:
1. More departments and faculty researchers are understanding the significantly positive value of conducting research on Army and DoD projects and its impact on their teaching cadets in the classroom, and
2. More organizations are aware of the impact US Military Academy researchers can have on their organization through the application of their analytical abilities combined with their military expertise.
The Dean of the Academic Board, BG Daniel Kaufman, wants to ensure that the outreach research program continues to grow by enabling researchers and facilitating their interaction with clients. Conversely, he also wants to ensure the research continues to improve the educational experience in the classroom and does not become its detriment. To accomplish this, BG Kaufman, requested the Department of Systems Engineering lead a team of analysts to determine the organization and approach required to meet the Academy's needs.
In this report we describe our application of the Systems Engineering and Management Process (SEMP) to the issue. This is the process we followed to develop our recommendation and explain our plan for implementation of that recommendation. The final recommended course of action which address the Dean's and other significant stakeholders needs, wants and desires is for the Academy to increase the size – and impact – of the Academic Research Division (ARD) and institute a Research Advisory Council to facilitate interdisciplinary interactions between departments and research centers.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF: d			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON LTC Michael J. Kwinn, Jr.
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified	None	64	19b. TELEPHONE NUMBER (include area code) 845-938-5529